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A Cross Sectional Study on Blood Transfusion In Hemoglobinopathies of Odisha

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Abstract

Background: Hemoglobinopathies like Sickle cell disease and Thalassemias, are now the common global health issues. These are genetically inherited hemoglobin disorders. Blood transfusion is cornerstone in its management. Transfusion protocols are more widely executed for thalassemia than in sickle cell disorders. But issues still remain with optimal hemoglobin levels and proper indications of blood transfusion. The transfusion regimen in the management of these disorders is stated in the National and International guidelines for treatment and prevention of hemoglobinopathies. Its execution can make a substantial improvement in care but awareness about it is a question among health care professionals and the targeted population. A cross sectional study on blood transfusion among hemoglobinopathies was conducted in different districts of Odisha through community-based camps over a period of 8 months i.e. February 2019 to September 2019. Patients those who participated in camp, were mostly transfused blood in their local district hospitals.

Materials and Method: The study included 430 patients; those belonged to different subsets of hemoglobin disorder. Reports of clinical diagnosis, their transfusion history and pre-transfusion hemoglobin in the previous transfusion were noted in all patients. Assessment of anemia was done among transfusion dependent hemoglobinopathies.

Result: Male gender was predominant in all categories. Most of Thalassemia Major
(86.8 %) on regular transfusion were found to be under-transfused in reference to transfusion guidelines for hemoglobinopathies. A wide variation in transfusion

requirement and ignorance in monitoring was observed in the subsets of Transfusion dependent β-thalassemia as in intermedia (βTI), HbE-β thalassaemia and Sickle-β thalassaemia.

Conclusion: Adequacy of blood transfusion should consider patient's weight, pre-transfusion hemoglobin and the volume of blood. Quality of blood equally weighs out its significance. Fresh, packed, pre-storage, leuco-depleted red cell from a selected donor with good hematocrit improves quality of blood. In practical ground, the health care professionals at periphery are still unaware of the transfusion regimen and its indication. However, the success rates in implementation of guidelines need more intensive educational drive and improved health facilitation.

Keywords: Hemoglobinopathy, Pre-transfusion hemoglobin, Transfusion dependent thalassemics, Non-transfusion dependent thalassemics.

Introduction

Hemoglobinopathies are the most common hereditary disorders of the hemoglobin molecule, manifests as one of the clinically serious genetic condition. Quantitative and qualitative hemoglobin disorders are thalassemia and Sickle cell disease respectively [1]. In India, the clinical forms of hemoglobinopathies causing huge socio economic burden are Thalassemia major, Thalassemia intermedia, Sickle cell disease and Hb E, either occurs singly or in combinations [2]. India is now known to be World's thalassemia capital with 40 million carriers [3]. Many are still undiagnosed and unreported. Few among them are optimally managed and more than 1, 00,000 thalassemia major undergo blood transfusion every month [4]. Blood transfusion plays a vital role in the management of patients with sickle cell disease and thalassemia [5]. As a fact, due to lack of access to treatment, 50% of thalassemia major do not survive beyond 25 yrs [3]. Life long blood transfusion is a recommended treatment for thalassemia major. They are transfused in every two to five weeks to maintain the pre-transfusion haemoglobin level above 9–10.5 g/dl, mean of 12.0 g/dl [6, 7].

For transfusion dependent hemoglobinopathies, adequacy of blood transfusion should consider patient's weight, pre-transfusion hemoglobin and the volume of blood. Quality of blood equally weighs out its significance. Fresh, packed, pre-storage, leuco-depleted red cell from a selected donor with good hematocrit improves quality of blood. In practical basis, at mass level both quality and quantity of blood transfusion were found to be compromised. Indications for initiation and discontinuation of transfusion should follow some standards which is focused in this cross-sectional study though the observational shortcomings in the camp.

Materials and method

Observational camp based study was conducted in four districts of Odisha (i.e., Balasore, Jajpur, Khurda and Sundergarh) in a period of 8 months i.e. February 2019 to September 2019. The patients those who participated had clinical presentation suggestive of hemoglobinopathies. Out of 520 patients, 48 patients had no HPLC reports and since long were following regular transfusion. Of total, 42 patients had HPLC reports but non-conclusive as they were transfused before the diagnosis was established. Therefore, 430 patients were included in the study population, whose HPLC reports were informative about their diagnosis.

Table 1: Gender Distribution in different hemoglobinopathies.

Major groups	Diagnosis	No. of patients	Gender	
			Male	Female
Thalassemia	Beta Thalassemia major(ßTM)	212	127	85
	Thalassemia intermediate (ßTI)	39	25	14
Combined hemoglobin--opathies	HbE – Beta Thalassemia (E-ßT)	74	39	35
	Sickle Beta Thalassemia (S-ßT)	47	29	18
Sickle cell disease	Sickle cell disease(SCD)	58	36	22
	Total	430	256	174

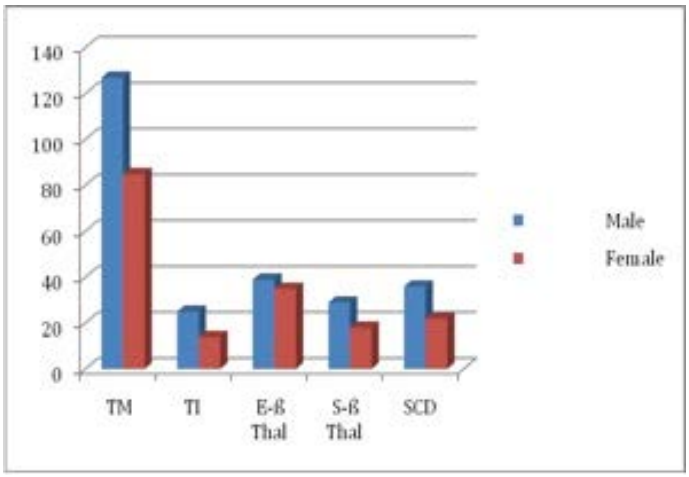

Fig.1: Gender Distribution in different hemoglobinopathies.

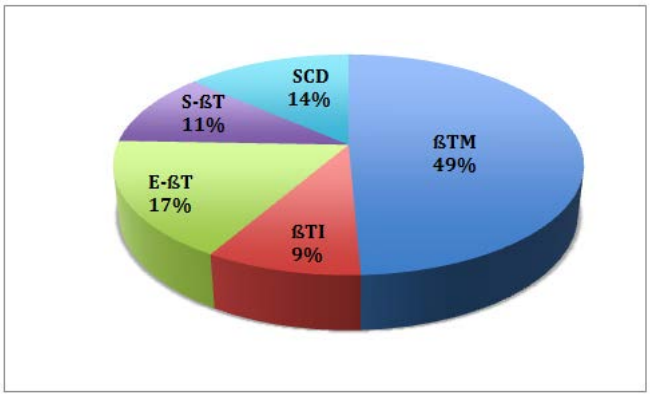

Fig. 2: Distribution of Hemoglobinopathies among patients

The clinical diagnosis was verified for each patient from his or her initial HPLC report done before the initiation of transfusion. Accordingly, the population of patients were categorized into different subsets of hemoglobinopathy that comprised of 49% Beta Thalassemia major (ßTM), 9% of Thalassemia intermediate (ßTI), 17% of HbE – Beta Thalassemia (E-ßT), 11% of Sickle Beta Thalassemia (S-ßT) and 14% of Sickle cell disease (SCD)[Table 1, Fig 2]. For better clinical correlation, a detail history at initial diagnosis (like the age at diagnosis and mode of initial clinical presentation) and complete blood transfusion details (which includes blood group, pre-transfusion hemoglobin, last date of transfusion, volume being transfused, type of blood, collection date of blood, post-transfusion reaction and frequency of transfusion) were collected. On the basis of blood requirement, the participants were broadly classified as transfusion dependent and non-dependent group [Table 2, Fig 3].

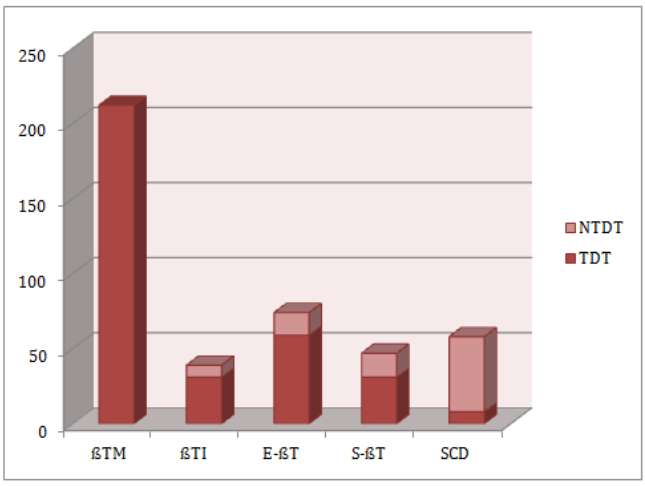

Fig. 3: Transfusion dependent and Non-dependent in different Hemoglobinopathies.

Results

The male and female patients were 256 and 174 respectively, in a ratio of 1.5 :1. The age range of the

patient participants were from 1 – 48 yrs. Majority of patients belonged to the age range of 5-15 yrs. Male dominance was found in all categories (Table 1, Fig.1).

Table. 2: Transfusion dependent and Non-dependents in different hemoglobinopathies.

SN.	Diagnosis	No. of patients	Transfusion	
			Dependent	Non-dependent
1.	Beta Thalassemia major (ßTM)	212	212	-
2.	Thalassemia intermediate(ßTI)	39	31	8
3,	HbE – Beta Thalassemia(E-ß)	74	59	15
4.	Sickle Beta Thalassemia (S-ß)	47	31	16
5.	Sickle cell disease(SCD)	58	8	50
	Total	430	341	89

Broadly on the basis of transfusion requirement, subjects were categorized as transfusion dependent beta thalassemia (TDßT) and non-transfusion dependent beta thalassemia (NTDßT).

In simple meaning, TDßT are those beta thalassemics who thrive on regular transfusion for life and NTDßT are those who can sustain life with normal physical activity sufficient for growth and development without transfusion support [8]. Among the TDßT, the most common blood group in ß-thalassemia major was O +ve followed by B +ve and A +ve. In rest, as the number of patients were less, therefore, no significant blood group correlation was found (Table 3, Fig. 4) [9].

Table 3 : Blood group in TDßT.

TDßT	A	B	AB	O	Others
Beta Thalassemia major (ßTM)	41	58	10	102	O-ve
Thalassemia intermediate (ßTI)	5	16	3	7	
HbE – Beta Thalassemia (E-ßT)	13	16	9	20	B-ve
Sickle Beta Thalassemia (S-ßT)	8	11	8	4	

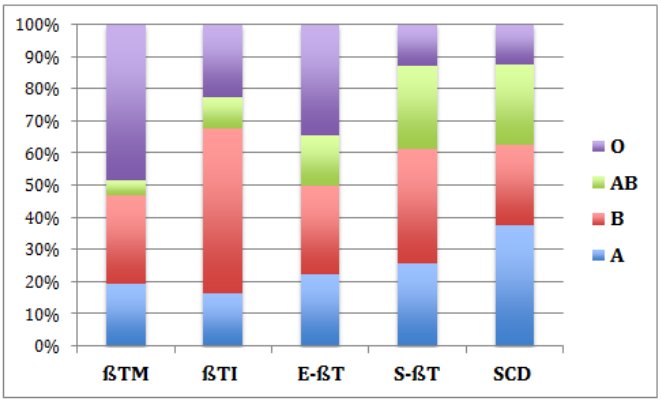

Fig. 4. Blood group in transfusion dependent hemoglobinopathies.

The predominant group among TDßT was Beta Thalassemia major 49%(212/430). The hemoglobin level in 87 % of ßTM was found below 8 gm/dl, of those 15% were below 6 gm/dl. Rest 13% were between 8-10 gm/dl (Fig. 5 and Table. 3).

All subjects of thalassemia major (100%) were on regular blood transfusion (Fig. 3 and Table 2). Excluding Thalassemia major and sickle cell disease, other category of thalassemia and its co-inherited forms were 37% (160/430). Of these, 9%(39/430) were ß Thalassemia Intermedia, 17% (74/430) were E-ß thalassemia and 11%(47/430) were Sickle-ß thalassemia. Out of 160 patients, TDßT with heterogenous need for transfusion were 75.6 % (121/160) and 24.3% (39/160) were NTDßT. The hemoglobin level was below 8 gm/dl in 74% (21% was

below 6 gm/dl). Rest 26% was between 8-10 gm/dl (Fig.6) (Table.3). The Sickle cell disease was 13 % (58/430).

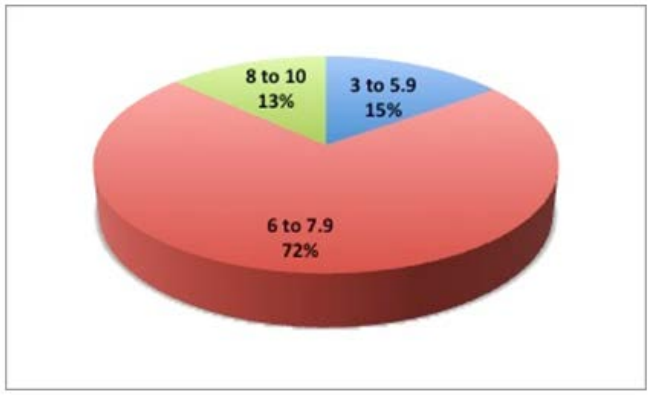

Figure 5: Thalassemia Major in different Hemoglobin ranges.

Table 4. Different TDßT with hemoglobin ranges.

TDßT with Hemoglobin ranges	4.0 to 5.9 gm/dl		6.0 to7.9gm/dl		8 to 10gm/dl	
	Total	On Transfusion	Total	On Transfusion	Total	On Transfusion
Thalassemia Major(ßTM)	32	32	152	152	28	28
Thalassemia Intermedia(ßTI)	8	7	26	21	5	3
E-ß Thalassemia (E-ßT)	17	15	38	35	19	9
S-ßThalassemia (S-ßT)	8	8	22	20	17	3

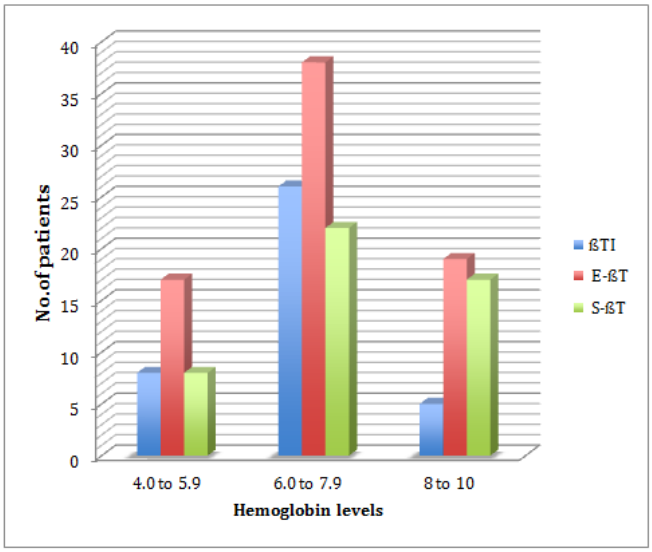

Figure 6: Distribution of Hemoglobinopathy in different Hemoglobin ranges.
(Excludes Thalassemia major and Sickle cell disease.)

Discussion

The prevalence of hemoglobinopathies in India is 1.2 per 1000 live births [10]. Thalassemias (quantitative defect) and Sickle cell disorder (qualitative structural variants) are the commonest worldwide monogenic hemoglobin disorder. Based on 27 million births per year in India, it has been suggested that there would be 32,400 babies born with serious hemoglobin disorder [11]. It is estimated that 10,000 to 15,000 babies of β-thalassemia major are born each year. India has an estimated burden of 1,50,000 patients of Thalassemia major and 1, 25,000 patients of sickle cell disease [2]. Transfusion protocols are more widely executed for thalassemia than in sickle cell disorders. Thalassemia is most common inherited autosomal recessive blood disorder. The incidence of beta thalassemia (ßT) in different regions of India varies from 3% to 17% with a mean prevalence of 4% [12]. For transfusion of these patients approximately 2 million units of packed red cells would be needed [8,13]. β-thalassemias are serious hereditary hemoglobin disorder, which results from genetic mutation in β sub unit, that causes an imbalance between α & β chains of hemoglobin [4,14].

Based on transfusion requirement, Beta Thalassemia (ßT) type of Hemoglobinopathy is broadly classified as Transfusion Dependent(TDßT) and Non-Transfusion dependent (NTDßT).

Transfusion Dependent category (TDßT):

Thalassemia major is a category of hemoglobinopathy which is transfusion dependent within 1st year of life and thrive on regular blood transfusion lifelong. If left untreated / non-transfused, they die in the first or second decade of life. The guidelines of the Thalassemia International Federation states that "regular transfusion to be initiated, when there is severe

anemia (<7 g/dl) on two separate occasions (one to two weeks apart) or when Hb levels is >7 g/dl and accompanied with poor feeding, inappropriate fatigue, developmental delay or symptoms of heart failure, after exclusion of contributing causes such as infections [15]. The indication for blood transfusion are variable in different categories of hemoglobinopathies.

Except Thalassemia major, rest all categories of thalassemia may have heterogeneous population of transfusion dependency. Those of TDßT, Thalassemia intermediate (ßTI), HbE – Beta Thalassemia (E-ßT) and Sickle Beta Thalassemia (S-ßT) differ in onset of clinical presentation and their transfusion requirements. They may behave like thalassemia major phenotypically or may require few to nil transfusion. There exist variability in transfusion need, based on the severity of hemolytic anemia. Those with severe form, follow regular transfusion as indicated with thalassemia major. However, mild or moderate form of hemolysis, usually maintain Hb level>7 g/dl without transfusion support.

In sickle cell disease, Chronic transfusion is for prophylaxis and is warranted for primary prevention of stroke and its recurrence, in-order to maintain HbS % below 30% [16]. Transfusion can be life-saving to avoid dreadful complications and is mostly episodic to improve micro vascular perfusion by decreasing the proportion of sickle red cells in the circulation.

Non-Transfusion dependent (NTDßT)

These category may not need transfusion as their hemoglobin level is sufficient for physical activity. Need of transfusion arises with sudden fall in hemoglobin, triggered by physiological stress like fever, infection and during growth and development [14]. Patients of NTDßT with lower hemoglobin levels are associated with higher prevalence of complications [17] which was also found in the camp survey. During their lives, they may shift between the categories of non-dependency to transfusion dependency or vis-versa [6] which necessitates regular monitoring .

Transition between non-transfusion to regular transfusion

For the decision to transfuse in NßTDT, one has to look beyond hemoglobin for several other factors like growth retardation, progressive splenomegaly, delayed/absent puberty, hemolytic facies resulting from ineffective erythropoiesis[15,18,19]. Especially older children, adolescents and adults should be regularly monitored for these features that may arise eventually [20]. Any of the above, as on evidence, the protocol of management should be differed from NTDßT to TDßT and follow regular transfusions till full adult height is attained (as evidenced by the growth plates fusion in bones) [21].

Transition between transfusion dependencies to non-transfusion dependent

Unnecessary transfusion should be avoided as it may cause iron loading and risk of extra-hepatic iron deposition. At times, TDßT may discontinue transfusion or may reduce the frequency of transfusions, if found to maintain hemoglobin level enough for normal physical activity, growth and maturity. In sickle cell disease, Episodic transfusion is for correction of severe anemia inorder to combat vaso-occlusive crisis or aplastic crisis.

Hydroxyurea (HU) treatment may have similar therapeutic effects of blood transfusion in other TDβT patients because it can compensate for defective β-globin chain production by increasing HbF production, partially corrects α and non-α globin chains imbalance. Thus, it ameliorates the hemolytic symptoms in these patients [22]. Moreover, several investigators have

found it to be effective and well tolerated with mild, transient adverse event. There was significant decrease of transfusion need in severe NTDβT, shown in the analytical study, with complete to partial response in the rates of transfusion. For mild NTDβT, it was effective in raising hemoglobin by 1 g/l [23].

Initially HU was approved as a possible therapeutic approach for reduction of painful crises in sickle cell patients [24] and now it is also known for its influence on transfusion in patients with β-thalassemia intermedia, HbE-β thalassemia, Sickle-β thalassaemia but its efficacy is controversial in β-thalassemia Major [25].

Beta Thalassemia major (ßTM)

It is the predominant group among TDßT and comprise of about 49% (212/430), those who required regular transfusion from infancy (within 1st year) to sustain life [6,7]. Age range was 1-29 yrs and Hemoglobin range was 3.4 - 9.6 gm/dl (Mean hemoglobin of 6.9 gm/dl). The pre-transfusion hemoglobin level in 87 % (184/212) were found below 8 gm/dl, of those 17% (32/184) were below 6 gm/dl and rest 13% (28/212) were between 8-10 gm/dl. Through camp based survey, an inference was drawn about the overall concept of health system in management of TDßT through one point analysis of pre-transfusion hemoglobin. The study was conducted with an objective to discuss about the present scenario of blood transfusion adopted in the community and underlying contributing factors for deviation from the formulated guidelines.

1. Transfusion Protocol in ßTM as per Guidelines

The transfusion regimen for Thalassemia major as stated in the National guidelines for the management and prevention of hemoglobinopathies is " Pre-transfusion Hemoglobin (Hb) should be kept between 9- 10.5 g/dl. Type of blood to be transfused should be packed red blood cells (pRBC) and whole blood should not be given. It should be administered in 15ml/kg body weight. The patient may require 1-2 units of pRBCs, or even more depending upon their body weight and pre-transfusion hemoglobin" [6,7]. If the annual blood requirement (ABR) rises above 200-220ml/kg/year then evaluation for the presence of red blood cell allo-immunization or hypersplenism should be done. In such case, splenectomy becomes a potential strategy [4].

2. Transfusion Protocol in ßTM at district levels

The patients were mostly transfused whole blood at 10 ml/kg within a range of hemoglobin level between 6 - 8 gm/dl. Quantity and quality were always questionable. The concept of packed red cell and leucodepletion were far away in practice at district hospitals. The treatment providers at the government health sector and the end users adopted a transfusion norm in accord to their convenience and availability of blood at blood bank. Irrespective of pre-transfusion hemoglobin, blood quality, volume and the date of its collection, were compromised at large mass level. Health providers at few govt. medical colleges and private health sectors across the state adopted the concept of hyper-transfusion. Depending upon severity of anemia, additionally iron absorption from the intestine increases to as much as 3 to 5 mg per day thus contributes 1-2 gm of iron load per year [6,7]. Thalassemia major is characterized by state of severe anemia that demands regular transfusion of fresh red cells in order to facilitate normal growth, physical activity and allow a good quality of life (QoL) [6]. On contrary, inadequate/under-transfusion can neither combat anemia nor suppress extra-medullary hematopoiesis. A compromised state of chronic anemia features with reduced physical activity, hemolytic facies, limited growth and organomegaly [18].

In this study, 13% (28/212) were transfused with packed red cell on regular basis at Hb level between 8-10 gm/dl. These sectors even evaluated the patients for hypersplenism and allo-immunization, indicative when consumption exceeded the desired level of requirement or when level of hemoglobin did not rise satisfactorily even after transfusions.

3. Comparison of present scenario versus National guidelines for transfusion in thalassemia major (ßTM) (Table 5)

Table 5. Comparision of transfusion protocol for Beta-thalassemia major (ßTM).

Transfusion Parameters	National guidelines	Present scenario
Type of blood	Packed red cell	Whole blood
Administered at	15 ml/Kg	10 ml/Kg
Pre-transfusion Hb	9-10.5 gm/dl	6-7.9 gm/dl
No. of units transfused	1-2 units according to pre-transfusion Hb	1 unit irrespective of low pre-transfusion Hb level
When to transfuse in relation to collection date)	< 7-14 days of collection	Any day till blood unit expires

4. Social Participation in Blood donation

Blood is a resource, which is replenished only by voluntary non-renumerated donors. One of the reasons for under-transfusion is also blood scarcity resulting from the lack of donors and the increasing transfusion dependent thalassemics. The misconception about blood donation among general population is found with hundreds of excuses, fear, myth and reason for self-demotivation at personal or family level. They would only donate if a relative or friend required blood. Majority of the population, still dwell in ignorance about thalassemia.

Beta Thalassemia intermediate (ßTI)

Of the total study population, 9%(39/430) were ß Thalassemia Intermedia. Within this group, 80% (31/39) were on regular transfusion with varied frequency. The age of clinical presentation in the patients differed from 6 months - 9 yr. As compared to ßTM, most of them usually manifested later than ßTM [26]. Age range was 1.6-33 yrs and hemoglobin range was 3.0 - 9.6 gm/dl (Mean hemoglobin of 6.7 gm/dl).

Threshold of low hemoglobin level for transfusion was co-related with their physical activity. Patients on increased duration within interim transfusion followed irregular to delayed transfusion till they fell sick. They had signs of struggle with symptoms of anemia, jaundice, hemolytic facies, massive organomegaly, failure of growth and development. Transfusion could have afforded significant benefits by individually tailored transfusion regimen [14,18, 27,28], which in turn required significant input and co-operation from the patient, family, and medical records.

Complex hemoglobinopathies in Co-inheritance

Several other clinical forms of β-thalassaemia includes its co-inheritance with haemoglobin E or Sickle cell trait, result in E-β thalassemia, Sickle - β thalassemia respectively. However, clinical presentation in these varies from relatively moderate to severe forms. It can present as severe anemia as similar to TM or moderate as in β-Thalassemia Intermedia.

HbE – β thalassemia (E-ßT)

Of the total study population, 17% (74/430) were E-ß thalassemia, which had extreme clinical heterogeneity and was a clinical concern. Family with two members of same diagnosis followed different transfusion protocol (dependent to non-dependent). Age range was 2- 31 yrs and hemoglobin range was 4.0 - 10 gm/dl (Mean hemoglobin among transfusion dependents was

6.9 gm/dl). Within this group, 66 % (31/47) were transfusion dependent. Patients with E-β thalassemia were found to tolerate better even at low hemoglobin than βTI [29]. In spite of maintenance on low hemoglobin level, they had good supportive evidence of favourable growth and maturity but hemolytic facies, features with anemia, massive organomegaly were found. Irrespective , those who maintained between 7 gm/dl – 8 gm/dl were even deficit with hemolytic features and extra-medullary hematopoiesis.

Sickle-β thalassaemia (S-βT)

When sickle cell is co-inherited with β-thalassaemia, it results in Sickle-β thalassaemia . Present study had 11% (47/430) of patients in this category. Within the group, 66% (31/47) were transfusion dependent and 34% (16/47) were non-transfusion dependent (Fig.2, Table 2.). Age range was 2- 30 yrs and hemoglobin range was 4.5 – 9.8 gm/dl. Mean hemoglobin among transfusion dependents was 7.4 gm/dl and the age range of clinical presentation was 1 yr-10 yrs. The clinical finding in S-β thalassemia was quiet variable, ranging from anemia, jaundice and painful vaso-occlusive crisis to completely asymptomatic condition.

Sickle cell disease (SCD): One among the structural variant of hemoglobinopathy is sickle cell disease. This subset had 13% (58/430), within these 14% (8/58) were on regular episodic transfusion and 86% (50/58) patients had either occasionally or never been on transfusion (Table 2). Age range was 3- 48 yrs and hemoglobin range was 6.2 – 12.6 gm/dl. Patients of sickle cell disease, those on regular transfusion, 5 had repeated complain of pain due to vaso-occlusion (splenic sequestration) and acute chest syndrome, non-responsive to hydroxyurea. Of them 2 were transfused prophylactically to prevent future complications, as they had past history of strokes and were on simple transfusion. One of them in transfused patients had Sickle cell disease with progressive complications of avascular necrosis of hip joints along with rheumatoid arthritis and osteoporosis.

Controlling all the symptoms of SCD is a great challenge and is especially crucial for those living in remote areas with poor socio-economic status. Sickle cell disease requires lifelong supportive care that includes hospitalization for management of debilitating pain, infection/sepsis, multi-organ failure and blood transfusion indicated for acute conditions like severe anemia, vaso-occlusive crisis, acute chest syndrome [16]. Pain is one of the symptoms that had a major impact on patient's quality of life.

Blood transfusion and treatment with hydroxyurea (HU) are the modalities of treatment. HU is the preferable first line treatment. In severely anemic patients, simple transfusion is preferred but on prophylaxis, exchange transfusion is the modality [30]. For both SCD and ßTM patients, the RBC units to be transfused should be fresh (between <7–14 days old) and negative for sickle cells [15,21,31]. Transfusion should be considered for management of acute illness or in those where hydroxyurea is contraindicated or is refractory.

This trend could not be inferred properly in the camp survey, because, those patients who were on hydroxyurea had improper monitoring and poor adherence to therapy. Firstly, in many districts, majority patients depend on government supply which is either irregular or not yet procured and secondly, lack of awareness among health professionals about the indications of HU.

Conclusion

The remarkable variation and the instability of the clinical phenotypes in hemoglobinopathies suggest a

careful treatment plan for each patient is required. The therapeutic approaches should be re-assessed over-time. They should be monitored timely with their transfusion protocol. Guidelines are the standards but variations are the flexible approach to be tailored as per assessment of patient's individual requirement.

Blood is non-renewable resource therefore should be properly utilized to combat significant health burden. The transfusion approach carries risk, hence in practical aspect decisions must balance the potential benefit and outweigh risk.

Blood collection drives, donor education and good practices in donor management need to be organized intensively. Voluntary non-remunerated blood donors should be encouraged with appreciation certificate of "Social participation to save life" and students above 18 years to be motivated with academic benefit of being a part to it. The public awareness campaign for blood donation should run in parallel to promote awareness and prevention of hemoglobinopathies.

Strict screening procedures to screen donors will make blood safer for all the community. Blood banks should be equipped with component separator, extended antigen typing , technology for leukodepletion etc.

These all requires meticulous public health planning, policy making [32] and active participation of the physicians. Public health and hospitals are a state subject. These policy guidelines are meant to establish uniform guidance throughout the state and adapt with modifications as appropriate. Inexperience and inadequate adherence of physicians to guidelines affects the overall health outcome.

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References

1. Angastiniotis M and Lobitz S. Review Thalassemias: An Overview;Int. J. Neonatal Screen, 2019; 5:16; doi:10.3390/ijns5010016.
2. DRAFT Policy For Prevention and Control of Hemoglobinopathies – Thalassemia, Sickle Cell Disease and variant Hemoglobins In India Ministry of Health and Family Welfare Government of India New Delhi 2018.
3. https://www.thehindu.com/sci-tech/health/time-for-a-national-policy-on-thalassaemia/article18401885.ece.
4. Souvenir, 9th National Thalassemia Conference November, 2018, New Delhi. https://thalassaemia.org.cy/event/9th-national thalassemia-conference-2018/.
5. ISBT International society of blood transfusion: Transfusion in hemoglobinopathies.
6. Prevention and control of hemoglobinopathies in india -thalassemias, sickle cell disease andother variant hemoglobins; National Health Mission Guidelines on Hemoglobinopathies in India Ministry of Health & Family Welfare Government of India, 2016.
7. Cappellini M-D, Cohen A, Porter J, Taher A, Viprakasit V. Guidelines for the management of transfusion dependent thalassaemia(TDT). 2014; TIF publication; 20.
8. Anand Kumar K, Radhakrishna N, Sachdeva A. Management of thalassemia in Indian perspective,A. Sachdeva (Ed.), Thalassemia:National Guidelines for management of transfusion dependent thalassemia and non-transfusion dependent thalassemia. 2014; 296-302.
9. Sinha PA, Mulkutkar SH, Bhavani JB. Study of distribution of ABO blood groups in ß-thalassemia

patients. Int J Res Med Sci. 2017;5(8):3479-3483.DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20173545

10. Colah R, Italia K, Gorakshakar A. Burden of thalassemia in India: The road map for control. Pediatric Hematology Oncology Journal. 2017; 2(4):79-84.
11. Grow K, Vashist M, Abrol P, Sharma S, Yadav R. β thalassemia in India: current status and challenges ahead, Int J Pharm PharmSci. 2014; 6;28-33.
12. Higgs DR, Thein SL, Wood WG. Distribution and population genetics of the thalassemias. In: Weatherall DJ, Clegg JB, editors. The Thalassemia Syndromes. 4th ed. Oxford: Blackwell Science. 2001; 237–84.
13. Marwaha N, Whole blood and component use in resource poor settings**,** Biologicals. 2010; 38: 68-71.
14. Taher AT, Weatherall DJ, Cappellini MD· Thalassaemia. Lancet. 2018; 391(10116):155-167. doi: 10.1016/S0140-6736(17)31822-6.
15. Taher A., Vichinsky E., Musallam K., Cappellini M.D., Viprakasit V. Guidelines for the Management of Non Transfusion Dependent Thalassaemia (NTDT) Thalassemia International Federation; Nicosia, Cyprus: 2013.
16. Davis BA, Allard S, Qureshi A, Porter JB, Pancham S, Win N, Cho G , Ryan K. Guidelines on red cell transfusion in sickle cell disease Part II: indications for transfusion on behalf of the British Society for Haematology. 18 November 2016.
17. Taher AT, Musallam K.M., Saliba A.N., Graziadei G., Cappellini M.D. Hemoglobin level and morbidity in non-transfusion-dependent thalassemia. Blood Cells Mol. Dis. 2015;55:108–109. doi: 10.1016/j.bcmd.2015.05.011.
18. Saliba A.N., Taher A.T. Morbidities in non-transfusion-dependent thalassemia. Ann. N. Y. Acad. Sci. 2016;1368:82–94. doi: 10.1111/nyas.13083.
19. United Kingdom Thalassaemia Society. Standards for the clinical care of children and adults with thalassaemia in the UK. 3rd edition. 2016. http://ukts.org/standards/Standards-2016final.pdf.
20. Thalassaemia International Federation. Guidelines for the management of non transfusion dependent thalassaemia (NTDT). http://thalassemia.com/documents/NTDT-TIF-guidelines.pdf.
21. Yardumian PT A, Shah, F, Ryan K, Darlison MW, Miller E, Constantinous G. Standards for the Clinical Care of Children and Adults with Thalassaemia in the UK. 3rd ed. London, UK: Thalassaemia Society; 2016.
22. Perrine SP. Fetal globin induction--can it cure beta thalassemia? Hematology Am SocHematolEduc Program. 2005:38–44.doi: 10.1182/asheducation-2005.1.38.
23. Algiraigri AH, Wright N A.M., Paolucci EO, Kassam A. Hydroxyurea for nontransfusion-dependent β-thalassemia: A systematic review and meta-analysis panel. Hematology/Oncology and Stem Cell Therapy. 2017;10(3):116-125. https://doi.org/10.1016/j.hemonc.2017.02.002.
24. Bordbar MR, Silavizadeh S, Haghpanah S, Kamfiroozi R, Bardestani M, and Karimi M. Hydroxyurea Treatment in Transfusion-Dependent β-Thalassemia Patients. Iran Red Crescent Med J. 2014; 16(6): e18028. doi: 10.5812/ircmj.18028.
25. Musallam K.M., Taher A.T., Cappellini M.D., Sankaran V.G. Clinical experience with fetal hemoglobin induction therapy in patients with β-

thalassemia. Blood. 2013;121:2199–2212. doi: 10.1182/blood-2012-10-408021.

26. Karimi M, Cohan N, De Sanctis V, Mallat NS, Taher A. Guidelines for diagnosis and management of Beta-thalassemia intermedia. Pediatric hematology and oncology. 2014; 31(7):583-96.
27. Taher A.T., Musallam K.M., Cappellini M.D., Weatherall D.J. Optimal management of β thalassaemia intermedia. Br. J. Haematol. 2011;152:512–523. doi: 10.1111/j.1365-2141.2010.08486.x.
28. Sleiman J, Tarhini A, Bou-Fakhredin R, Saliba A N, Cappellini MD, and Taher AT. Non-Transfusion-Dependent Thalassemia: An Update on Complications and Management. Int J Mol Sci. 2018; 19(1): 182. doi: 10.3390/ijms19010182
29. Porter J. Optimal blood transfusion therapy in haemoglobinopathies. Thalassemia Reports. 2018; 8:7477.
30. Howard J. Sickle cell disease: when and how to transfuse. Hematology Am Soc Hematol Educ Program. 2016; 2016(1).
31. Al-Riyami AZ and Daar S. Transfusion in Haemoglobinopathies Review and recommendations for local blood banks and transfusion services in Oman. Sultan Qaboos Univ Med J. 2018; 18(1): e3–e12. doi: 10.18295/squmj.2018.18.01.002.
32. Weatherall DJ. The challenge of haemoglobinopathies in poor resource countries. Br. J. Haematol. 2011, 154, 736–744.